Docket No. 02-IMP-037 EATNP139US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re **PATENT** application of:

Applicant:	Benveniste
Application No.:	10/669,186
For:	ION BEAM SLIT EXTRACTION WITH MASS SEPARATION
Filing Date:	September 24, 2003
Examiner:	David Vanore
Art Unit:	2881

(FIRST) REPLACEMENT BRIEF ON APPEAL

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

January 4, 2008

To the Commissioner:

This (First) Replacement Brief on Appeal is filed in response to the Notification of Non-Compliant Appeal Brief mailed December 07, 2007. In particular, a revised Status of Claims (37 C.F.R. § 41.37(c)(1)(iii)) (section III. of the Appeal Brief) is provided wherein the claims being appealed are more clearly listed, and the Grounds of Rejection to be Reviewed on Appeal (37 C.F.R. § 41.37(c)(1)(vi)) (section VI. of the Appeal Brief) is revised to be as indicated in the Final Office Action.

I. Real Party in Interest (37 C.F.R. § 41.37(c)(1)(i))

The real party in interest in the present appeal is Axcelis Technologies, Inc.

II. Related Appeals and Interferences (37 C.F.R. § 41.37(c)(1)(ii))

Appellant, appellant's legal representatives, and/or the assignee of the present application are unaware of any appeals or interferences which will directly affect, or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. Status of Claims (37 C.F.R. § 41.37(c)(1)(iii))

Claims 1-17 and 21-29 are pending in the application, claims 18-20 have been cancelled. The rejection of independent claims 1, 21, and 29 is appealed.

IV. Status of Amendments (37 C.F.R. § 41.37(c)(1)(iv))

No claim amendments have been entered subsequent to the final rejection.

V. Summary of Claimed Subject Matter (37 C.F.R. § 41.37(c)(1)(v))

Independent claim 1 provides a mass analyzer 412 comprised of a first permanent magnet 402 and a second permanent magnet 403 and without electromagnets that generates a substantially uniform magnetic field 414 but not an electric field. Similarly, independent claim 21 provides generating a magnetic field 414 from only a first permanent magnet 402 and a second permanent magnet 403 and not generating an electric field. Likewise, independent claim 29 provides a mass analyzer 412 comprised of a first permanent magnet 402 and a second permanent magnet 403 that generates a substantially uniform magnetic field 414 but not an electric field. (Page 11, lines 3-26; page 12, lines 13-28; page 14, lines 1-14; page 15, lines 11-29; Figs. 4-6).

VI. Grounds of Rejection to be Reviewed on Appeal (37 C.F.R. § 41.37(c)(1)(vi))

Rejection of independent claims 1, 21 and 29 under 35 U.S.C.§ 103(a) as being unpatentable in view of Benveniste, (USPN 5,554,857) in view of Davis (USPN 3,711,706) with Vahrenkamp (USPN 4,315,153) cited as showing the advantage imparted by using Permanent Magnets.

VII. Argument (37 C.F.R. § 41.37(c)(1)(vii))

A. REJECTION OF CLAIMS 1, 21, and 29 UNDER 35 U.S.C. § 103(a)

Claims 1, 21 and 29 are rejected under 35 U.S.C.§ 103(a) as being unpatentable over Benveniste (USPN 5,554,857) in view of Davis (USPN 3,711,706) and Vahrenkamp (USPN 4,315,153). Reversal of the rejection is respectfully requested for at least the following reasons.

i. The suggested combination is not proper.

Independent claim 1 provides a mass analyzer 412 comprised of a *first permanent magnet 402 and a second permanent magnet 403* and ***without electromagnets*** that generates a substantially uniform magnetic field 414 ***but not an electric field***. Similarly, independent claim 21 provides generating a magnetic field 414 from ***only*** *a first permanent magnet 402 and a second permanent magnet 403* and ***not*** *generating* ***an electric field.*** Likewise, independent claim 29 provides a mass analyzer 412 comprised of *a first permanent magnet 402 and a second permanent magnet* 403 that generates a substantially uniform magnetic field 414 *but* ***not an electric field.*** (Page 11, lines 3-26; page 12, lines 13-28; page 14, lines 1-14; page 15, lines 11-29; Figs. 4-6).

The primary reference of Benveniste teaches the use of electromagnets rather than permanent magnets. In particular, ***the electromagnets in Benveniste have coils and are specifically employed to provide flexibility that allows the magnetic field to be adjusted*** (*See, e.g.*, Col. 2, lines 35-40; Col. 4, lines 24-27; Col. 5, line 54 – Col. 6, line 14). For example, the reference explicitly states:

> The strength of both the quadrapole and dipole fields are adjusted by a controller electrically coupled to the primary and additional current carrying coils of said magnet.
>
> A magnet constructed in accordance with the invention adds flexibility to the implanter. This flexibility allows the implanter to be used with different species ions at low energy implant levels. (Col. 2, lines 47-53).

Therefore Benveniste does not teach permanent magnets as claimed, and instead teaches the importance of electromagnet for varying the magnetic field magnitude for tuning purposes. Accordingly, Benveniste must be modified in some manner to arrive at the claimed invention.

Davis is thus cited for modifying Benveniste, where Davis provides that a C-shaped magnet of a mass spectrometer may comprise a permanent magnet (Col. 2, lines 37-34). However, obviousness is not established by merely showing that claimed elements existed, independently, in the prior art. KSR v. Teleflex, 550 U.S. _____ (2007). Modifying a prior art reference is appropriate when one of ordinary skill in the art would have been motivated to do so. Such motivation may be found in the nature of the problem to be solved, in the teachings of the prior art, or in the general knowledge of persons of ordinary skill in the art. MPEP § 2143.01 (I) (*citing* In re Rouffet, 149 F.3d 1350 (Fed. Cir. 1998)). However, ***if a proposed modification would render the prior art unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification.*** MPEP § 2143.01 (V) (*citing* In re Gordon, 733 F.2d 900 (Fed. Cir. 1984)).

It is respectfully submitted that the suggested combination is not proper at least because ***modifying Benveniste to merely comprise the permanent magnets of Davis would render Benveniste unsuitable for its intended purpose (of adding flexibility – above), thus teaching away from the suggested combination.***

Davis acknowledges that a non-permanent (electromagnet) is preferred because it advantageously permits control of the magnetic field (Col. 2, lines 35-51). Thus, given Benveniste stated desire to provide ***flexibility*** and Davis' preference for an electromagnet, it is respectfully submitted that the suggested combination is not proper at least because one of ordinary skill in the art would not be motivated to make the modification. That is, one of ordinary skill in the art would not be motivated to exchange the electromagnets of Benveniste with the permanent magnet of Davis since Davis explicitly recognizes that a non-permanent magnet is preferred, and because such a modification would render Benveniste unsuitable for its intended purpose (of added flexibility).

Vahrenkamp is cited as supplying a motivation to utilize a permanent magnet in that it would reduce size and complexity. This point, however, fails to appreciate the teachings of Vahrenkamp ***as a whole***. MPEP § 2143.01 (I) (*citing* In re Fulton, 391 F.3d 1195 (Fed. Cir. 2004)(stating that the proper inquiry is "whether there is something in the prior art as a whole to suggest… the obviousness of making the combination.")

Taken properly as a whole, Vahrenkamp does not provide the requisite motivation ***because its primary functionality is not employed in Benveniste.*** Benveniste employs coils that vary the current to alter a ***magnetic field*** strength to vary the tuning of the mass analyzer for differing species. Vahrenkamp, on the other hand, varies the ***electric field*** in a ExB separator for tuning purposes. More particularly, Vahrenkamp teaches potential plates 24, 26, 28, 30 (Col. 3, lines 25-55); 64, 66, 68, 70 (Col. 4, line 50 – Col. 5, line 23); or 94, 96, 98, 100 (Col. 5, lines 30-35) of an ExB separator 20, 60 or 90, respectively, that can be biased to different voltages to develop ***different electric fields to select a desired mass species*** (Col. 3, lines 38-39). ***The ExB separator in Vahrenkamp must employ an electric field for tuning the separator for different species.*** In fact, Vahrenkamp specifically states that it is directed to the ExB separator for analyzing ion beams (Col. 1, lines 66-68). The claims of the present invention, however, explicitly preclude an electric field in the mass analyzer. As such, one of ordinary skill in the art would not have been motivated to modify Benveniste with the teaching of Davis or Vahrenkamp when Vahrenkamp is properly evaluated as a whole. Therefore the combination of Benveniste with the secondary references is improper due to a lack of the requisite motivation. Consequently, claims 1, 21 and 29 are non-obvious over the cited art.

To the extent that one of ordinary skill in the art would have been motivated to modify Benveniste in view of Vahrenkamp, such a modification would most likely have been to add potential plates to incorporate a variable electric field for further tuning flexibility. However, such a modification would not have rendered obvious the claimed invention because the claims specifically recite a mass analyzer that generates a uniform ***magnetic field, but not an electric field***. Therefore the pending claims are non-obvious over the cited art.

It will be appreciated that the use of permanent magnets as provided in claims 1, 21 and 29 allows a substantially uniform magnetic field of adequate magnitude to be produced in a small region (not attainable with electromagnets), and that this field applies a specific uniform force in a desired direction across a ribbon ion beam. Given the demands of modern ion implanters that implement ribbon ion beams this can not practicably be accomplished without using permanent magnets because, among other things, the footprint of the implanter would become unreasonably large.

It is respectfully submitted, therefore, that independent claims 1, 21 and 29 are non-obvious over the cited art. The other claims remaining in this case depend from claims 1, 21 or 29 and thus are also non-obvious over the cited art.

Withdrawal of this rejection is therefore respectfully requested.

B. CONCLUSION

For at least the above reasons, the claims currently under consideration are believed to be patentable over the cited references. Accordingly, it is respectfully requested that the rejections of the pending claims be reversed.

For any extra fees or any underpayment of fees for filing of this Brief, the Commissioner is hereby authorized to charge the Deposit Account Number 50-1733, EATNP139US.

Respectfully submitted,
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VIII. Claims Appendix (37 C.F.R. § 41.37(c)(1)(viii))

1. (Previously Presented): A ribbon beam ion implantation system comprising:

an ion source operable to generate multiple ion species from a source material;

an extraction system configured to extract the ion species from the ion source and generate a ribbon-shaped ion beam; and

a mass analyzer comprised of a first permanent magnet and a second permanent magnet and without electromagnets that generates a substantially uniform magnetic field but not an electric field across a beam path of the ribbon-shaped ion beam to select a species from the multiple species initially present in the ribbon-shaped ion beam.

2. (original): The system of claim 1, further comprising an acceleration system aligned along the beam path that operates on the ion beam after the mass analyzer and accelerates or decelerates the ion beam to a predetermined implantation energy level.

3. (original): The system of claim 1, wherein the extraction system is a triode extraction system operative to produce a converging beam.

4. (previously presented): The system of claim 1, wherein the ion beam extracted by the extraction system is at a low energy.

5. (Previously Presented): The system of claim 4, wherein the low energy is about 500 eV.

6. (original): The system of claim 1, wherein the magnetic field generated by the mass analyzer has a length of about 5 cm through which the ion beam travels.

7. (original): The system of claim 1, wherein the magnetic field is oriented along the ribbon-shaped ion beam's short dimension.

8. (Previously Presented): The system of claim 1, wherein the magnetic field has rapidly decaying fringes.

9. (original): The system of claim 1, wherein the multiple species include B+, F+, BF1+ and BF2+, and the selected species is B+ or BF2+.

10. (original): The system of claim 1, wherein the multiple species include P+ and H+ and the selected species is P+.

11. (original): The system of claim 1, wherein the source material comprises boron trifluoride (BF3).

12. (original): The system of claim 1, wherein the source material comprises phosphorous pentafluoride (PF5).

13. (original): The system of claim 1, wherein the source material comprises arsenate (As5).

14. (original): The system of claim 1, wherein the ion beam has a width of about 300 mm.

15. (original): The system of claim 1, further comprising an end station having a wafer, wherein the ion beam is operative to implant the selected species on the wafer in a single pass.

16. (original): The system of claim 1, wherein the extraction system comprises a control circuit operable to receive one or more inputs indicative of a desired ion species, and output a set of predetermined voltages for electrodes associated with the extraction system based on the one or more inputs.

17. (original): The system of claim 16, wherein the set of predetermined voltages dictates an extraction energy of the ribbon-shaped ion beam entering the mass analyzer.

Claims 18-20 (canceled)

21. (Previously Presented): A method of generating a ribbon type ion beam comprising:

generating multiple ion species from an ion source;

extracting the multiple ion species to form a ribbon-shaped ion beam having a short dimension and a wide dimension, wherein the wide dimension is substantially larger than the short dimension;

generating a magnetic field from only a first permanent magnet and a second permanent magnet and not generating an electric field, wherein the first permanent magnet and the second permanent magnet comprise a mass analyzer; and

selecting a species and rejecting other species of the multiple species of the ion beam via the magnetic field of the mass analyzer.

22. (original): The method of claim 21, further comprising accelerating/decelerating the ion beam to a desired energy level after selecting the species.

23. (original): The method of claim 21, further comprising directing the ion beam towards a target wafer at an end station.

24. (original): The method of claim 23, further comprising performing an ion implant on the target wafer with the ion beam in a single pass, wherein the target wafer has a diameter of about 300 mm and the wide dimension of the ion beam is greater than about 300 mm.

25. (original): The method of claim 21, wherein the species is selected by applying a magnetic field via permanent magnets that deflects the ion beam across its short dimension.

26. (original): The method of claim 21, wherein extracting the multiple ion species comprises:

identifying the selected species; and

configuring extraction electrodes with a set of predetermined voltages such that the extracted ribbon-shaped ion beam has an energy that is a function of the identified selected species.

27. (Previously Presented): The system of claim 1, wherein the mass analyzer is positioned downstream of the extraction system.

28. (Previously Presented): The system of claim 1, wherein the generated magnetic field deflects undesired species from the beam path.

29. (Previously Presented): A ribbon beam ion implantation system comprising:

an ion source that generates a plurality of ion species from a source material;

an extraction system that extracts the plurality of ion species from the ion source and generate a ribbon-shaped ion beam comprising a plurality of species; and

a mass analyzer positioned downstream of the extraction system comprised of a first permanent magnet and a second permanent magnet that generates a substantially uniform magnetic field but not an electric field across a beam path of the ribbon-shaped ion beam to select a species from the plurality of species present in the ribbon-shaped ion beam.

IX. Evidence Appendix (37 C.F.R. § 41.37(c)(1)(ix))

No additional evidence not already part of the official record is relied upon in the arguments provided herein.

X. Related Proceedings Appendix (37 C.F.R. § 41.37(c)(1)(x))

Not applicable.